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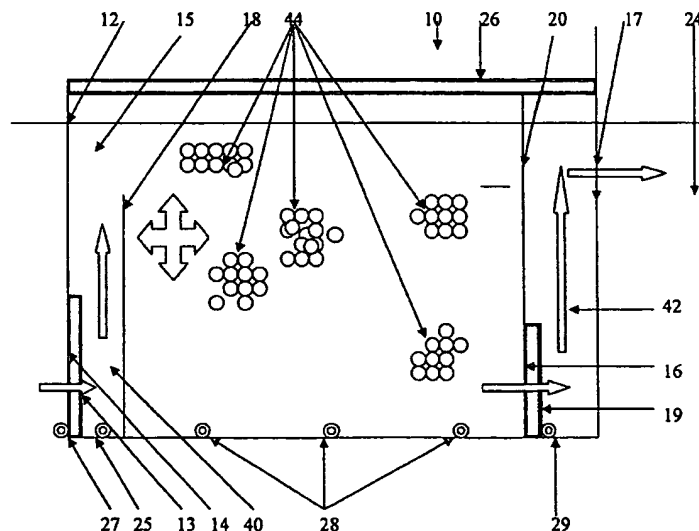
(71) Applicant and  
(72) Inventor: NICHOLSON, Dermot, Peter [NZ/AU]; 10 Gloucester Street, Nelson bay, NSW 2315 (AU).

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(54) Title: WASTE TREATMENT APPARATUS



(57) Abstract: The disclosed waste treatment apparatus is a container designed for the treatment of domestic and medium grade liquid waste. It uses mobile media, fixed activated sludge, and air, oxygen or other suitable gas in the treatment process. It is adapted for use in any organic waste treatment stream. It is designed to absorb significant shock loading both hydraulic and organic and minimize the negative effect on effluent quality. It is a modular design for total flexibility and simplicity of installation. The many advantages of the present invention over the prior art will become readily apparent to those persons skilled in the art from the following description. According to one aspect of the present invention there is provided waste treatment apparatus which includes a container having a main treatment chamber therein, an inlet means for delivering material to be treated to the main treatment chamber and an outlet means for discharging treated material from the main treatment chamber. The

apparatus further includes flow generating means for generating a flow of material through the chamber and support media means for carrying micro-organisms, the support media being disposed within the main treatment chamber and movable therein in response to the flow of material through the chamber. The arrangement is such that the waste material within the treatment chamber is subjected to a bacterial process which breaks down the complex compounds into simpler compounds. In the preferred application where the apparatus is used with a septic tank the container is adapted to be disposed within the septic tank.

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## Waste Treatment Apparatus.

This invention relates generally to the treatment of organic waste such as for example, waste water.

5 A preferred application of the apparatus of the present invention concerns its use with septic tanks and for the treatment of the sewage water contained therein. It will be convenient to hereinafter describe the invention with reference to this particular application although it is understood that this is not to be taken as a limitation of the scope of the invention.

10 It is an object of the present invention to provide an improved and efficient apparatus for treating waste.

The many advantages of the present invention over the prior art will become readily apparent to those persons skilled in the art from the following description.

15 According to one aspect of the present invention there is provided waste treatment apparatus which includes a container having a main treatment container therein, an inlet means for delivering material to be treated to the main treatment chamber and an outlet means for discharging treated material from the main treatment chamber. The apparatus further includes flow generating means for generating a flow of material through the chamber and support media means for carrying micro-organisms, the support media being disposed within the main treatment chamber and movable therein in response to the flow of material through the chamber.

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The arrangement is such that the waste material within the treatment chamber is subjected to a bacterial process which breaks down the complex compounds into simpler compounds. In the preferred application where the apparatus is used with a septic tank the container is adapted to be disposed within the septic tank.

25 In one preferred form, the support media includes a plurality of discrete elements such as for example of a particular nature which are disposed within the main treatment chamber

and freely movable therein. Preferably, the support media is adapted to float in the material within the treatment chamber. The support media is adapted to carry the microorganisms which perform the aerobic bacterial process on the material within the chamber. The support media may be formed from any suitable material such as for example, plastics or the like. The discrete elements may be of any suitable shape such as for example, spherical, cubic or irregularly shaped.

Preferably, the container is in the form of a vessel having a side wall and a base wall. The container may be open at the top or have a removable cover. The vessel may be of any suitable shape and formed from any suitable material.

The inlet means may be in the form of an inlet aperture in the side wall of the container and a passage disposed internally of and spaced from the container side wall. The passage may be defined by a partition in the interior of the container. Preferably, the inlet aperture is disposed towards a lower section of the side wall of the container with, an inlet transfer opening preferably disposed towards an upper region of the container which provides communication between the inlet passage and the main treatment chamber.

The outlet means may also include an outlet aperture in the side wall of the container and a passage internally of the container wall. Preferably, the outlet aperture is disposed in the container side wall opposite the inlet aperture so that the treatment chamber is disposed therebetween. Preferably, the outlet aperture is disposed towards the top portion of the container and an outlet transfer opening is formed in a partition separating the passage from the treatment chamber which is disposed towards the bottom of the container. By this arrangement a convoluted flow path is provided between the inlet aperture and the outlet aperture.

In one preferred form, the flow generating means may include a gas diffuser disposed preferably adjacent the inlet aperture. A plurality of such diffusers may be provided in the inlet passage, the outlet passage, and also within the main treatment chamber. The diffusers may be in the form of a pipe having gas discharge outlets in the wall thereof, the pipe being

disposed on the base of the container. The gas used may be air, oxygen or any other suitable gas.

Preferably, filter means may be provided at the inlet aperture to inhibit the passage of large solids into the apparatus. A gas diffuser may be provided adjacent the filter for keeping the filter clear of solids. The filter may be in the form of mesh or the like. A further filter means may be provided at the outlet transfer opening. This may be similar in construction to that described above.

In order to enable a clearer understanding of the invention, drawings illustrating example embodiments are attached, and in those drawings;

Figure 1 is a schematic side elevation drawing of waste treatment apparatus according to one aspect of the present invention;

Figure 2 shows schematic drawings of the waste treatment apparatus, according to one aspect of the present invention, in plan and side elevation with some details removed;

Figure 3 shows schematic drawings of waste treatment apparatus, according to a second embodiment of the present invention, in plan and with two end elevations.

Referring to Figures 1 and 2 there is shown a first embodiment of waste treatment apparatus according to the present invention which is generally indicated at 10 and includes a container 12 comprising three sub-chambers one defining an inlet passage 40 in fluid communication with main treatment chamber 22 in fluid communication with a chamber defining an outlet passage 42. The chambers are defined by partitions 18,20 which are in spaced relation, parallel with the side walls of the container, extending vertically approximately 75% of the distance between the top and bottom faces of the container. Partition 18 defines a volume approximately 15% of the total volume of the container 12, with an opening in the upper region of the container 12. Partition 20 defines a volume of similar size, but with the opening in the lower region of container 12.

The apparatus further includes an inlet opening 13 in the side wall of the container which is in communication with the inlet passage 40. The inlet opening 13 has a filter in the form of a screen 14 which extends across the inlet opening. The apparatus further includes an outlet opening 17 in the side wall of the container through which treated material is discharged. In addition transfer openings 15 and 19 provide communication between the inlet and outlet passages and the main treatment chamber. The outlet transfer passage 19 has a filter screen 16 which extends thereacross.

The apparatus further includes a flow generator in the form of a gas diffuser 25 in the inlet passage and diffuser 29 in the outlet passage. Additional gas diffusers 28 may be disposed at spaced intervals along the base of the container. An external diffuser 27 assists in cleaning the filter at the inlet.

Support media 44 in the form of discrete floating elements are disposed within the main treatment chamber.

The operation of the waste treatment apparatus of this embodiment will hereinafter be described particularly with references to Figures 1 and 2.

The container 12 is at least partially immersed in a septic tank, which is already generally filled with organic waste. The organic waste fills the three chambers 22, 40, 42 of the container 12, and immerses the media 44 and microorganisms. The pump is activated and pushes the gas [in this case, air or pure oxygen] through the diffusers 28 and keeps the microorganisms aerated. The air movement also creates hydrodynamic forces which draw the organic waste through the inlet filter 14, and up through the air inlet chamber 40. The waste is then drawn past the media 44, upon which the microorganisms are fixed. The microorganisms on the surface of the media begin breaking down the organic waste. The conditions required for good microorganism growth are oxygen and organic waste. For efficient waste treatment, it is important that there be dense populations of microorganisms, which is the reason for the surface-area-increasing devices on the media.

Treated waste is then drawn downwards, through the outlet filter 16 and into the outlet chamber and back into the main septic tank.

5 Placement of air diffusers adjacent the filter screens maintains fluid flow tangent to the screens, thus keeping them clear. Filter screens 26 at the top of the container 10 allow waste material to overflow out through the top of the container without the loss of media 44 or microorganisms. All movement of waste material occurs via hydrodynamic forces, set in motion by the pump and air diffusers. Hydrodynamic forces keep the media 44 and the microorganisms from moving into the entry chamber 40. Filter screen 16 keeps the media from moving into the outlet chamber 42. The filter screens 14 and 16 keep solids from the treatment chamber container 12, as they must be broken down further before microorganisms may efficiently treat them.

Air velocity must be monitored, or the microorganisms will lose their grip on the media 44, and be swept away.

15 Referring to Figure 3 there is a second embodiment of waste treatment apparatus according to the present invention which is generally indicated at 110 and includes features and operation similar to the first embodiment except for the location of the partitions 112 and 114, which are now parallel to each other and define inlet and outlet chambers which share as part of their boundaries, a common container wall.

20 As mentioned earlier the waste treatment apparatus is suitable for use in septic tank systems. The apparatus converts the anaerobic inlet chamber of an existing or new septic tank into an aerated/aerobic mixed liquor chamber, greatly improving effluent quality. The apparatus easily retrofits into most existing septic systems. It reduces the smell associated with septic tanks and its simplicity of design and low operating pressures enable it to be made inexpensively and from light-grade materials. It is adaptable for use as a polishing unit in  
25 any organic waste treatment stream. Apart from the air pump, there are no mechanical moving parts. It is designed to absorb significant shock loading both hydraulic and organic and minimize the negative effect on effluent quality. The apparatus is designed as a module so that multiple units may be used in series or parallel for denitrification, phosphate

reduction, etc processes. The treated effluent may be used for fertilizer for agricultural purposes after disinfection, and the mixing method and mobile media ensure that the system is self cleaning.

5 It will be understood that the term "comprises" or its grammatical variants as used herein is equivalent to the term "includes" and is not to be taken as excluding the presence of other elements or features.

10 Finally, it is to be understood that the inventive concept in any of its aspects can be incorporated in many different constructions so that the generality of the preceding description is not to be superceded by the particularity of the attached drawings. Various alterations, modifications and/or additions may be incorporated into the various constructions and arrangements of parts without departing from the spirit or ambit of the invention

Dermot Peter Nicholson

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Date.. 17-12-02

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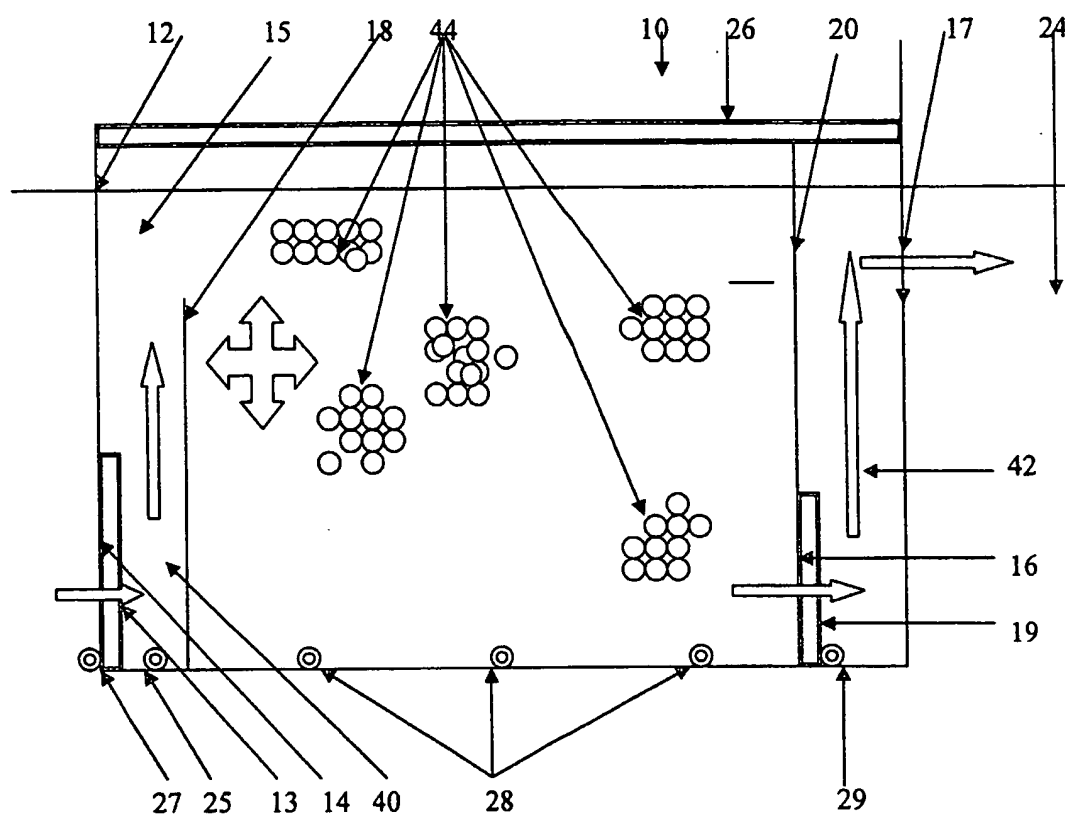
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The claims defining the invention are as follows:

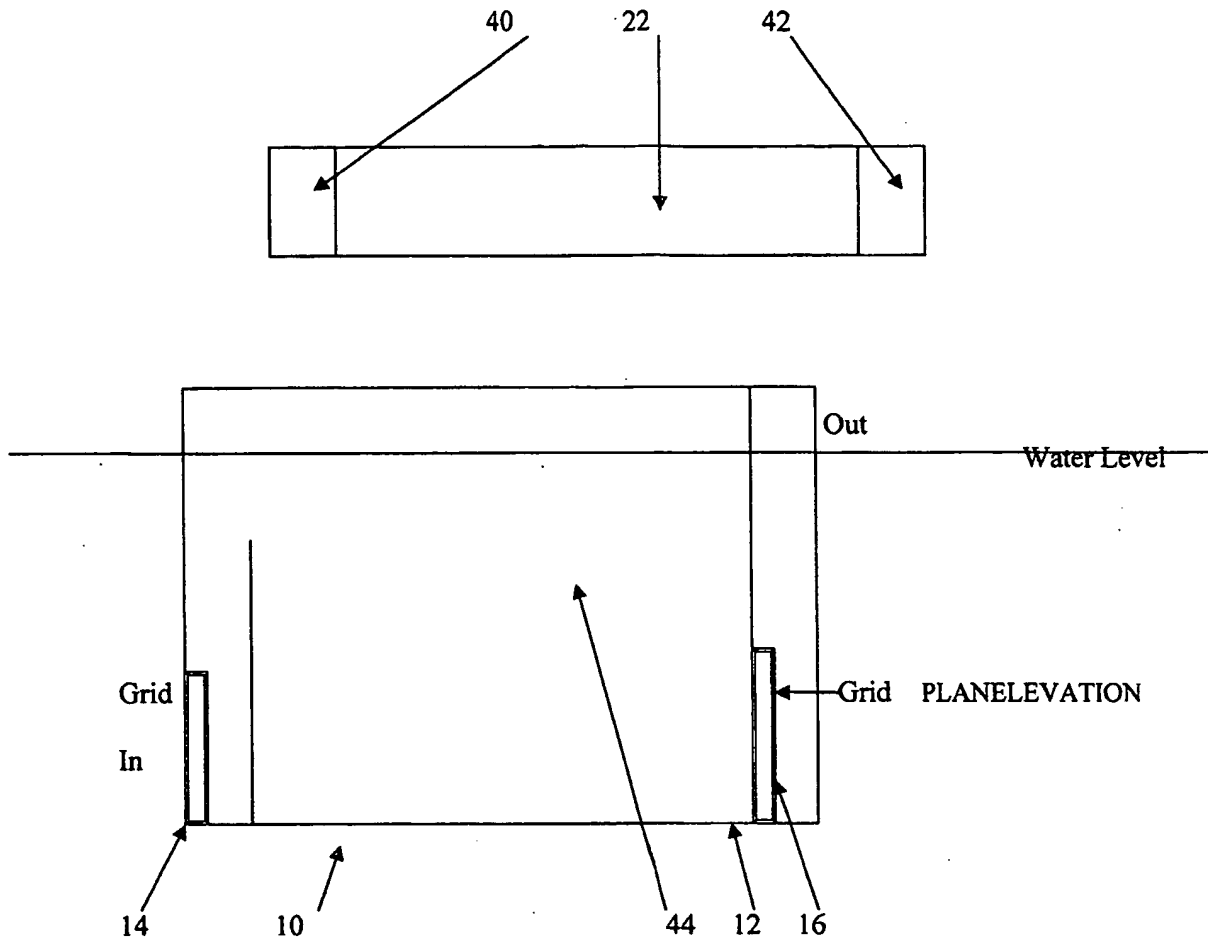
1. A waste treatment apparatus comprising a container having a main treatment container therein, an inlet means for delivering material to be treated to the main treatment chamber and an outlet means for discharging treated material from the main treatment chamber.
2. The apparatus further includes flow generating means for generating a flow of material through the chamber and support media means for carrying micro-organisms, the support media being disposed within the main treatment chamber and movable therein in response to the flow of material through the chamber.
3. The arrangement is such that the waste material within the treatment chamber is subjected to a bacterial process which breaks down the complex compounds into simpler compounds. In the preferred application where the apparatus is used with a septic tank the container is adapted to be disposed within the septic tank.
4. In one preferred form, the support media includes a plurality of discrete elements such as for example of a particular nature which are disposed within the main treatment chamber and freely movable therein.
5. Preferably, the support media is adapted to float in the material within the treatment chamber. The support media is adapted to carry the microorganisms which perform the bacterial process on the material within the chamber.
6. The support media may be formed from any suitable material such as, for example, plastics or the like.
7. The discrete elements may be of any suitable shape such as for example, spherical, cubic or irregularly shaped.
8. Preferably, the container is in the form of a vessel having a side wall and a base wall. The container may be open at the top or have a removable cover. The vessel may be of any suitable shape and formed from any suitable material.





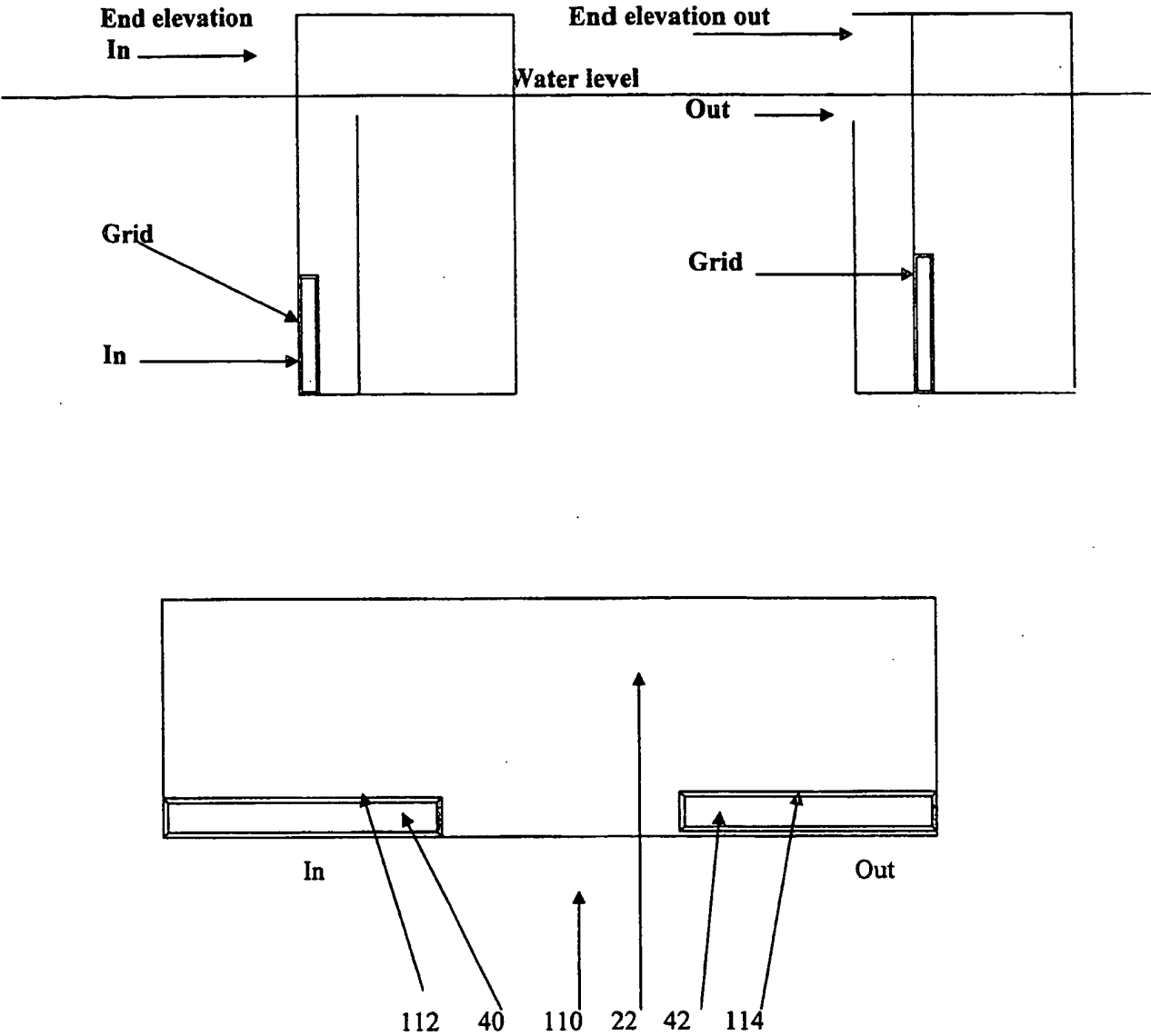
Liquid Direction is shown by 

### Figure 1



DOMESTIC UNIT \_ STANDARD SEPTIC TANK INSERT

**Figure 2**



DOMESTIC UNIT – PLUS LIGHT COMMERCIAL SEPTIC TANK UNIT

Figure 3

## INTERNATIONAL SEARCH REPORT

International application No

PCT/AU02/01700

<b>A. CLASSIFICATION OF SUBJECT MATTER</b>		
Int. Cl. C02F 3/08, 3/10		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols)		
REFER ELECTRONIC DATA BASE CONSULTED		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
DWPI IPC C02F 3/08, 3/10 & Key words ( septic tank)		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent Abstract Accession No.2002-743360/81, Class P43, JP 2001286878 A (NITSUKO KK) 16 October 2001	1-8
X	US 5958239 A (SING) 28 September 1999 whole document	1-8
X	CA 2247561 A (COUTURE) 14 March 2000 whole document	1-8
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
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Date of the actual completion of the international search 25 February 2003		Date of mailing of the international search report 06 MAR 2003
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929		Authorized officer  ASOKA DIAS-ABEYGUNAWARDENA Telephone No : (02) 6283 2141

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International application No.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent Abstract Accession No. 1999-520804/44, Class D15, JP 11221589 A (HITACHI CHEM CO LTD) 17 August 1999	1-8
X	Derwent Abstract Accession No. 2000-516606/47, Class D15(D16), JP2000153290 A (HITACHI CHEM CO LTD) 6 June 2000	1-8
X, P	Derwent Abstract Accession No. 2002-660483/71, Class D15, JP 2002166285 A (TASUTEMU KK) 11 June 2002	1-8

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU02/01700

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member
US	5958239	NONE
		END OF ANNEX